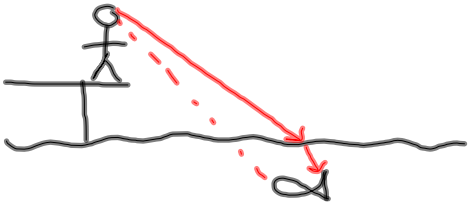
Test Tomorrow!

- Waves
- Sound
- Light



- Because the angle changes as the light enters the water, we need to aim at the front of the fish to hit it

- What changes (of frequency and wavelength) when light enters a new medium?

$V = f\lambda$ → this changes
↳ stays constant
↳ this changes

we observe that the color (which is related to frequency) does not change, so we conclude that the frequency does not change.

- All parts of the electromagnetic spectrum travel at the same speed in a vacuum.

$V = f\lambda$ Speed of a wave

$c = f\lambda$

$f = \frac{1}{T}$ relationship between frequency and period

$n = \frac{c}{v}$ index of refraction

$E = hf$ energy of light

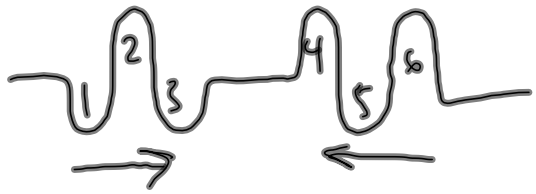
$n_1 \sin\theta_1 = n_2 \sin\theta_2$ Snell's law

$I = \frac{P}{4\pi r^2}$ intensity of sound

$f_n = \frac{nv}{2L}$ $n = 1, 2, 3, \ldots$ open/open pipe strings

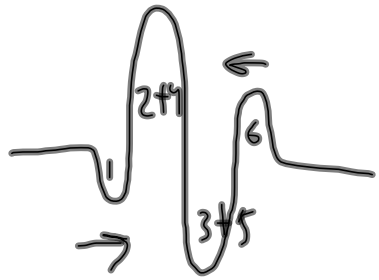
$f_n = \frac{nv}{4L}$ $n = 1, 3, 5 \ldots$ open/closed pipe

1)

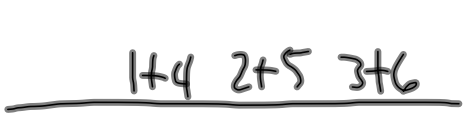


2)

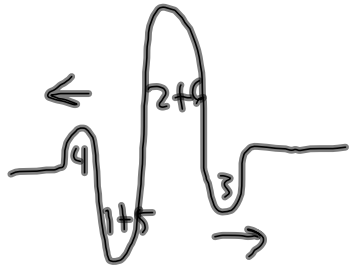
3)



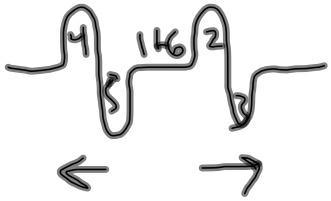
4)



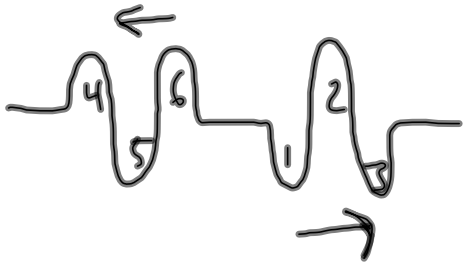
5)

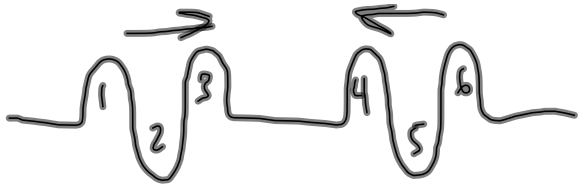


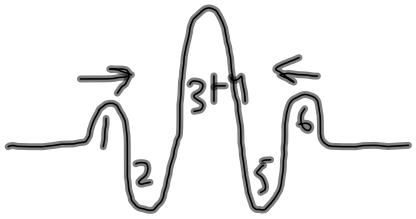
6)



7)

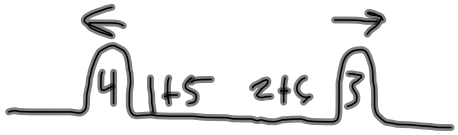


1) 

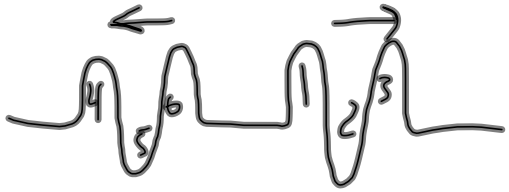
2) 

3) 

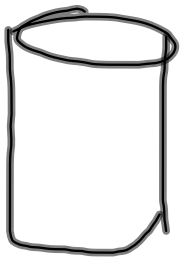
4) 

5) 

6) 

7) 

An open/open pipe playing the 7th order frequency has a frequency of 4500 Hz. If the speed of sound in air is 343 m/s, what is the length of the pipe?



$f_n = \frac{nv}{2L}$

$n = 7$

$v = 343\ m/s$

$f_7 = 4500\ Hz$

$L = \frac{nv}{2f_n}$

$= .26\ m$

An open/closed pipe has a length of 4.56 m. What frequency is produced at the following harmonics if the velocity of sound in air is 343 m/s?
a) 3rd order frequency
b) 4th order frequency
c) 9th order frequency

$$f_n = \frac{nv}{4L}$$

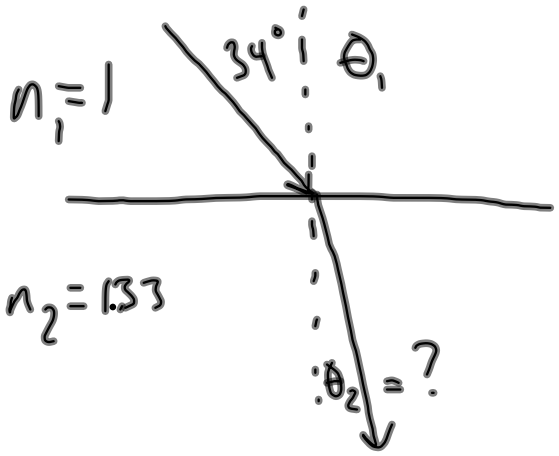
only use odd harmonics

a) $f_3 = \frac{(3)(343\ m/s)}{2(4.56\ m)} = 56.4\ Hz$

b) f_4 = Does Not Exist

c) $f_9 = 169.2\ Hz$

Light travels from air (n = 1) to water (n = 1.33), and the incoming angle is 34 degrees. What is refracted angle as the light enters the water?

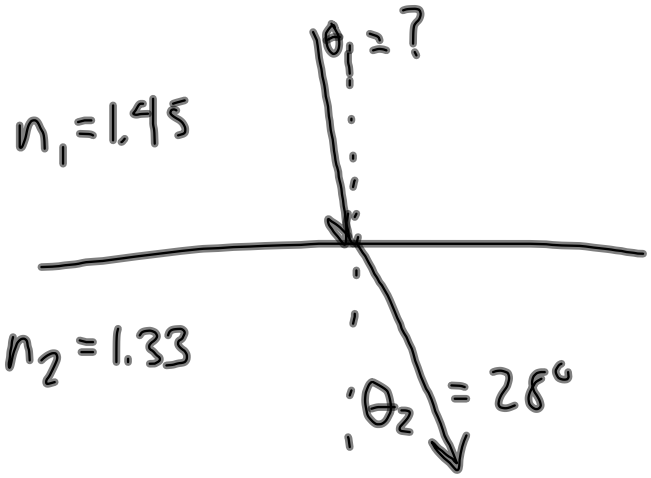


$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

$$\theta_2 = \sin^{-1}\left(\frac{n_1}{n_2}\sin\theta_1\right)$$

$$= 24.9°$$

A light beam travels from glass (n = 1.45) to water (n = 1.33). If the beam leaves at 28 degrees, what angle did the beam enter the boundary?



$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

$$\theta_1 = \sin^{-1}\left(\frac{n_2}{n_1}\sin\theta_2\right)$$

$$= 25.5^\circ$$